Title: Skipping into Multiplication

Brief Overview:

This activity develops the concept of multiplication through the use of patterns. The students will construct and identify arrays and use skip counting to complete patterns. Students will use the function of the constant key on the calculator to show skip counting and to develop the understanding of multiples.

Link to Outcomes:

- **Problem Solving** Students will demonstrate their ability to solve problems in mathematics including problems with open-ended answers, problems which are solved in a cooperative atmosphere, and problems which are solved with the use of technology.

- **Communication** Students will demonstrate their ability to communicate mathematically. They will read, write, and discuss mathematics with language and the signs, symbols, and terms of the discipline.

- **Reasoning** Students will demonstrate their ability to reason mathematically. They will make conjectures, gather evidence, and build arguments.

- **Connections** Students will demonstrate their ability to connect mathematics topics within the discipline and with other disciplines.

- **Concepts of Whole Number Operations** Students will understand various meanings of multiplication.

- **Patterns and Functions** Students will recognize, explain, and extend patterns. They will use the constant function on the calculator.

Grade/Level:

Grade 3 or 4
Grade 2 with limited modification

Duration/Length:

This learning unit will take approximately 2 weeks.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Repeated addition
- Concept of equal
- Recognizing patterns
- Pictographs
- Money

Objectives:

Students will:

- follow a number pattern to skip count using a hundreds chart.
- use the constant function on the calculator.
- create an array.
- identify the number sentence to match an array.
- identify multiples of a given factor.
- use and understand a multiplication table to find a product.
- use and understand the terms product, factor, and multiple.
- identify patterns on a table.
- use patterns to solve a problem.

Materials/Resources/Printed Materials:

Activity 1:

- Two Ways to Count to Ten, by Ruby Dee (Henry Holt, 1988)
- Curriculinks Grade 3 - 4, Creative Publications (resource)
- Large hundreds chart on display
- Student copies of hundreds chart
- TI-108 calculators
- Crayons or colored pencils
- Balls
- SKIPMULT Resource Sheet #1

Activity 2:

- Teaching Children Mathematics, March 1995, pg. 446-450, "Teaching Patterns, Relationships, and Multiplication as Worthwhile Mathematical Tasks" by Barbara E. Armstrong
- Crayons or colored pencils
- Scissors
- One inch graph paper
- SKIPMULT Resource sheets #2 and #3
- Butcher paper

Activity 3:

- SKIPMULT Resource sheets #4 and #5
- Two sets of labels 1 to 9
- Display of arrays from Activity Two

Activity 4:

- Curriculum and Evaluation Standards for School Mathematics, Addenda Series, Fourth Grade Book, NCTM, 1992.
- Resource Sheet #6
- Calculators
- Large 12 by 12 multiplication table with the all the multiples of 6 colored **each** time they appear
- Large sheet of blank paper and marker for each group

Development/Procedures:

Activity 1:

- Read the story, <u>Two Ways to Count to Ten</u>, by Ruby Dee. (Summary of story is on SKIPMULT Resource Sheet 1 if book is not available.)

- Let discussion of story lead to a discussion of skip counting and number patterns involved. Generate a list of different ways to skip count.
  - -What is the best way to skip count to one hundred if you are in a hurry?
  - -Which is faster, skip counting to 20 by twos or to 100 by tens?
  - -Does it make a difference which skip counting pattern you choose?

- Allow students to explore things that can be done in the length of time it takes to skip count to 100 different ways. (For example: throwing a ball in the air and clap twice before it hits the ground.)

- Explore skip counting using the constant function key of the calculator. (Most school calculators should work if you press "0 + any number = = = = ".)

- Have students color a skip counting pattern on their own hundreds chart using one color. Display the colored charts and discuss the patterns. Children may use calculators to help complete, check, or to practice skip counting. (Teacher may choose to explore the difference in patterns created on a hundreds chart from 0 - 99 as compared to 1 - 100.)

- Have students write everything they have learned about skip counting by creating a web in their journal.

- Homework Activity (use SKIPMULT Resource Sheet #12).

Activity 2:

- Display SKIPMULT resource sheet #2 on the overhead. Have the students think-pair-share the definition of an array by identifying the characteristics. (array - an arrangement of objects in rows and columns. Arrays give a special way to look at equal groups.)

- Display the arrays of the multiples of five which you have prepared using inch graph paper and discuss the pattern shown (see Row 5 of SKIPMULT Resource Sheet #3).

- Arrange the students into cooperative groups of 2 or 3 students. Assign each group a different color and a factor of one to nine. Each group should create the arrays for the multiples of that factor by coloring and cutting inch graph paper.

- Display the arrays on a large piece of chart paper or butcher paper as shown in SKIPMULT Resource Sheet #3. Lead a discussion using the arrays.
  - -How did you create your arrays?
  - -What is the same/different about each color?
  - -What patterns do you see?
- Give each student a copy of Resource Sheet #3 . Have them color to match the large display and answer the question.

Activity 3:

- Complete SKIPMULT Resource Sheet #4.

- Using the array display choose one of the larger arrays and think-pair-share ways to find how many blocks are in the array. List strategies on the board and discuss the most efficient method.

- Using the previous discussion, lead to identifying the concept of multiplication and the terms factor and product. Model how to write a multiplication number sentence.

- Label the columns and rows on the large display with the factors 1 to 9.

- Using SKIPMULT Resource Sheet #3 as a guide, the students will fill in the products on SKIPMULTResource Sheet #5.

- Write in student journals the answer to, "What does 4 x 5 mean? Convince me!"

Activity 4:

- Complete SKIPMULT Resource Sheet # 6 by having students fill in the products for factors 10, 11, and 12. Students may use the constant key on their calculators.

- Model listing multiples of six and coloring all the multiples of six on a completed 12 by 12 multiplication table. Discuss the patterns.

- Assign cooperative groups of 2 to 3 students. Each group will be assigned one of the following factors: 2, 3, 4, 5, 7, 8, 9, 10, 11, or 12.

- Students may assign the tasks of listing all the multiples up to 144 for their factor and coloring the multiples each time they appear on the table.

- Allow enough time for groups to investigate completed tables. Have each group summarize their findings using a marker on a large sheet of paper.

- Display each groups completed table and large summary sheet. Ask the students to report on what they have discovered. The discussion may be facilitated by asking the following questions:
    - -Are there any tables with the same pattern?
    - -Is there anything similar between the tables?
    - -Do you see a difference between the tables with multiples of odd factors and the tables with even factors?
    - -What do you think the pattern would be for the table of 13 or 17, and why do you think so?
    - -If you were to fold the table along the diagonal--from top left to bottom right--what do you notice?
    - -Why didn't I assign the factor 1 to a group?

Performance Assessment:

Throughout the unit students can be evaluated based upon the following:
-group participation and performance. Check daily for individual participation.
-daily journal writing.
-understanding of arrays to represent multiplication.
-recognition of patterns.
-understanding of relationship between skip counting and multiplication.
Summative assessment on SKIPMULT Resource Sheets #7 - 10.
Rubric for assessment is SKIPMULT Resource Sheet # 11.

Extension/Follow Up:

1. "Going in Circles" activity, page 3, from Curriculum and Evaluation STANDARDS for School Mathematics, ADDENDA SERIES, Fourth Grade Book, NCTM, 1992.

2. Read Sea Squares, Hulme, Joy N. (Hyperion Books for Children, 1991). Students can create patterns of the perfect squares on multiplication charts.

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Two Ways to Count to Ten
Summary

This is a brief summary of a Liberian folktale. The summary is based on the book, <u>Two Ways to Count to Ten</u>, retold by Ruby Dee.

Long ago all animals lived together in peace, ruled by their beloved ruler the leopard. King Leopard decided to seek out the cleverest beast in the jungle to be named prince and trained to rule should King Leopard die. The king planned a great feast and invited all the animals in the jungle. After the feast King Leopard announced a contest - "With this spear, I will test you. He who would be our prince must throw the spear toward the sky. He must send it so high that he can count to ten before it comes down again."

The elephant was the first to try. "One, two, three," he began counting. But before he said "four" the spear dropped to the earth. Next came the bush ox. He flung the spear far above his head, but before he could say "five," the spear was on the ground. The chimpanzee was third. He threw the spear toward the sky and began to count quickly. Just as he said "eight," the spear fell into his hand. Many other animals tried, even the mighty lion, but one by one they all failed.

Finally a slender antelope stepped forward. The other animals laughed. How could this puny antelope hope to succeed, when so many others had failed? The antelope tossed the spear far up into the air. Before it could fall to earth, he called out five words. "Two, four, six, eight, ten!" he cried. "I have counted to ten. King Leopard did not say how the count was to be made."

King Leopard laughed and said, "This clever antelope has won the contest. He shall be named the prince."

What is an Array?

These are arrays.

xxxxx
xxxxx

****
****
****
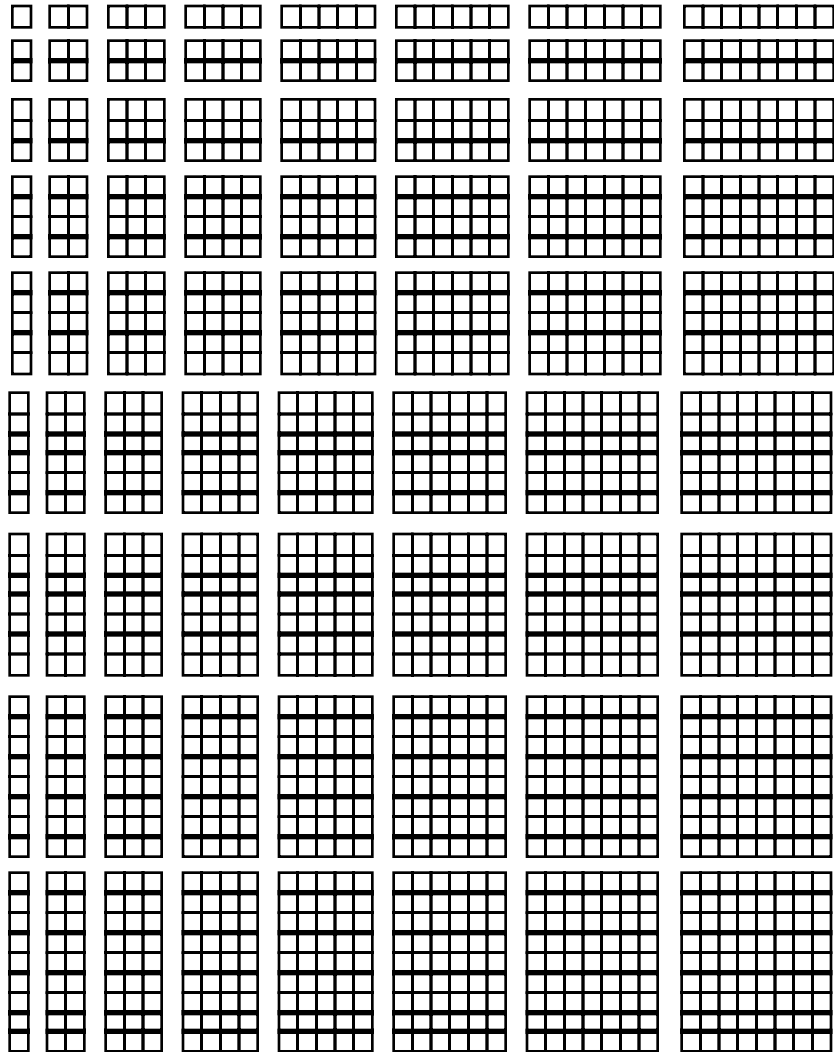*********

These are not arrays.

@ @ @ @
@ @
@ @ @ @

& & & &
& & &
& &

Characteristics of an array

_____

Definition of an array

Multiplication Arrays

What do arrays show?

_____

_____

_____

_____

_____

Name _____   Date _____

Number Patterns

Complete the following patterns.

1. 2, 4, 6, _____, _____, _____, _____, _____, 18, 20

2. 8, 12, 16, _____, _____, _____, _____, _____

3. 9, 12, 15, _____, _____, _____, _____

4. 7, 14, 21, _____, _____, _____, _____, _____

5. 1, 2, 3, _____, _____, _____, _____, _____, _____

6. 16, 24, 32, _____, _____, _____, _____, _____

7. 10, 15, 20, _____, _____, _____, _____, _____

8. 9, 18, 27, _____, _____, _____, _____, _____, 81

Choose one number pattern from above and explain the strategy you used to complete the pattern.

_____

_____

_____

_____

9 x 9 Multiplication Table

X	1	2	3	4	5	6	7	8	9
1									
2									
3									
4									
5									
6									
7									
8									
9									

12 X 12 Multiplication Table

| 1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18			
3	6	9	12	15	18	21	24	27			
4	8	12	16	20	24	28	32	36			
5	10	15	20	25	30	35	40	45			
6	12	18	24	30	36	42	48	54			
7	14	21	28	35	42	49	56	63			
8	16	24	32	40	48	56	64	72			
9	18	27	36	45	54	63	72	81			
10											
11											
12											

The Stamp Contest

The post office is having a contest for elementary school students to design a page of stamps. You will be preparing a page for this contest and writing an explanation of your page of stamps.

Activity One

Here is a page design from last year.
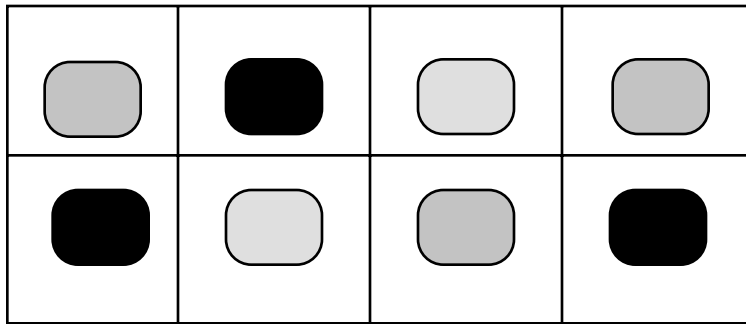
1. How many stamps are on this page? _____

2. If three of these pages made a book, how many stamps were in the book? _____ Use the space below, to show how you solved this problem.

3. If each stamp on this page is worth 6¢, how much will the book cost? Explain your solution.

_____

_____

_____

_____

Activity Two

There are three different topics for stamp designs. Everyone in the third grade has chosen their topic. Your teacher has asked you to display the information as a pictograph. Use the information on the table below to make the pictograph.

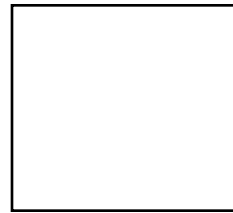# Topics of Stamps Chosen by Third Grade

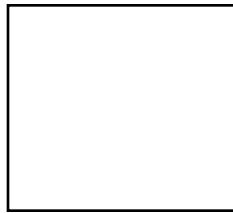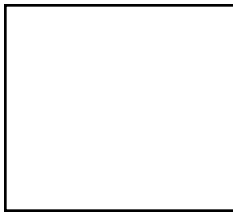| Topics	Number of Students
Sports	20
Animals	50
Space	30

Activity Three

Now you are ready to design a page in your stamp booklet.

1. Choose one of the following topics: sports, animals, or space, and write it on the line below.

_____

2. Design a different symbol that represents your topic for each of the following stamps.

3. Now decide how many stamps will be on each page. All of the stamps above must be arranged in a pattern on the page. Show the pattern in the space below. Remember there must be an equal number of stamps in each row.

4. Write a paragraph to describe your page of stamps.

_____

_____

_____

_____

_____

_____

_____

_____

SCORING TOOL FOR PICTOGRAPH (Activity 2)

2 - Student included all the elements of a pictograph (key, title, symbols, labels).
Student used symbols which were worth more than one to demonstrate knowledge of skip counting.
The value of the symbols was correct.

1 - Student included some elements of a pictograph.
Student showed some understanding of skip counting.

0 - Student included few elements of a pictograph.
Student showed no understanding of skip counting.

SCORING TOOL FOR STAMP PAGE (Activity 3)

2 - Student made a correct array.
Student made a pattern.

1 - Student made an array or a pattern.

0 - Student did not make an array or a pattern.